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SOME OBSERVATIONS ON BREEDING, WHELPING AND REARING *

By

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DUNDEE

Breeding

The endless questions that clients ask about breeding, whelping and rearing caused me great concern for many years and the "third degree" questioning by dog breeders was, for a long time, my greatest fear. My most difficult task was to get a useful understanding of whelping. The notes that follow will give some idea of my views at present.

Darwin states, "It is surprising how soon a want of care, or a care wrongly directed leads to degeneracy of a domestic race." These remarks apply particularly to dog breeding and I try to keep them in mind when I am consulted regarding the suitability of an animal for breeding. A bitch selected for breeding should be a presentable specimen and should have, in addition to good sound physical qualities, a suitable nature and such other attributes as are particularly desirable. Clean habits and a friendly nature are looked for in a house pet; a good nose—soft mouth—guarding qualities—speed, etc., in the various other breeds. The dog selected should be strong in any weaknesses of the bitch and should usually be of better quality than the bitch.

A bitch normally comes in season every six months but the first season is often delayed until considerably beyond that time, while not infrequently the age exceeds a year when the first heat occurs; thereafter considerable variation is not unusual, some bitches coming in season only once yearly.

There is a tendency for season to be early in summer and late in winter. I do not favour a bitch having pups before she is 18 months old. A stud dog is usually some two years old or over and can mate with justice only two bitches a week, though it is not advisable to maintain this rate.

For a number of reasons, it may be found difficult to mate a bitch. Obstruction in the vagina caused by stricture, persistent hymen, or growths is quite common and in such cases the bitch usually objects strongly to the dog's attention. Objection is also usually manifest if mating is attempted too early in heat or too late. At the twelfth day from the first evidence of season or heat it is usual to attempt mating and, if necessary, again on the 13th or 14th day. At this stage the female genitalia are at their maximum degree of congestion and the thick haemorrhagic and quite copious discharge of oestrus has changed to a few drops of clear red fluid. Some bitches for no obvious reason, object strongly to being mated.

In dealing with the mechanical type of obstruction, I operate under spinal anaesthesia, injecting into the lumbosacral space 1 c.c. of 2½ per cent. percain for every 10 lb. bodyweight, and endeavour to effect a remedy.

Stricture is the commonest obstruction to be corrected. A well-lubricated finger of the left hand is forced into the vagina to tense the stricture while a long stilette penetrates above and parallel to the vagina and the constricting cords are picked off until sufficient relaxation is obtained. In many cases very little is required and the vaginal mucous membrane is quite intact. In others an extensive incision, opening the vagina, may be required and in such haemorrhage may be considerable. The external skin wound is very small and no stitching is needed.

The persistent hymen, which may be very thick and fleshy, calls for enlargement of the lumen. This seems a very simple operation but I find it quite the opposite, there being nothing to distinguish this structure from the vagina. Extension is effected by cautious radial incisions.

Growths are usually polypi arising from the floor of the vagina just anterior to the opening of the urethra. The mucous membrane of the normal vagina is thrown into many loose longitudinal folds and a particularly high fold is present on the floor. It seems that this fold extends backwards and results in the polypus. In many cases there is a narrow neck which permits easy removal; in others the base is sessile and great care is required to avoid damage to the urethral orifice. I usually operate with a large catheter in the urethra and when the growth cannot easily be removed *per vaginam*, I enter above this by a perpendicular incision between the anus and vulva, leaving the latter intact. Good access is obtained in this way.

The above operations are done when the animal is in season and with the exception of the case operated on for persistent hymen, it is not usual to mate till next season.

When mating is objected to without apparent reason, it is usual to restrain the bitch by holding the collar at the left side of the animal in the closed left fist and by supporting the hind quarters with the palm of the right hand on the abdomen, the second and third fingers being passed between the hind legs to each side of the vulva. Good control of movement is obtained and help can be given in directing the penis.

When mating impulse is weak in either sex, I think that benefit may result from the use of 1/20 gr. yohimbine. I give three doses daily for three days before mating is attempted. Stilboestrol and such, with my very small experience of them, I find to be dangerous to use for this purpose. Stilboestrol given within two days of mating has been very successful in preventing conception but it is not without disadvantages—greatly protracted season and irregular sexual behaviour are common results. Recently a bull terrier bitch after this treatment became such a nuisance that ovariectomy was performed.

In mating, erection of the penis should not be completed until the bulb of the glans is within the vagina where it is retained by constriction of the vulva. This "tying" should be maintained for some 10 to 20 minutes; throughout all this time ejaculation occurs. Not infrequently "tying" fails and in these cases it is desirable that the penis be held in the vagina for some considerable time. The hold used for restraining the bitch is employed, the second and third

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fingers of the right hand being passed up behind the bulb of the glans to secure the penis. It is not difficult to maintain this hold for some ten minutes. When the penis is released from the vagina, it is fully erect and may continue to ejaculate for some considerable time. Due to constriction by the prepuce, it may become further engorged and even oedematous and remain everted. Immersion in cold water causes immediate involution. Its return into the prepuce may be eased by lubrication.

At or about the time a bitch is in season she should be freed from external and internal parasites. This is particularly important with round worms. Treatment, to be successful, must be repeated every 10 to 14 days until no further worms are expelled, or better still, until faeces examination reveals them to be clear of worm eggs. The dose I use is 1 m. of oil of chenopodium for every 5 lb. body weight. It causes no noticeable upset and worms are expelled with a normal motion in 12 to 24 hours.

I consider that the most reliable indication of pregnancy is a regular increase of weight which in the smaller breeds is about ½ lb. per week. At about the fifth week, abdominal distension is usually obvious. Exercise should be normal but distress avoided. Diet is increased according to appetite, especially during the last month. It should be varied and well balanced, with the nutritive ratio reduced close to 1 : 3, and nourishment should be increased by a third.

There is occasionally some vaginal discharge during pregnancy. This usually is harmless. A gelatinous discharge—clear, slightly white/yellow, or occasionally of a greenish tint—commonly indicates that parturition is imminent. It is not usual to observe this earlier than 48 hours before whelping; in addition, there is the usual fullness of mammae, restlessness, nesting, scraping and tearing of bedding. The animal usually refuses solid food for 12 hours preceding whelping.

Ideal whelping quarters should be warm, draught free and quiet; while out of bright light, they yet must be so situated that the various stages of whelping can be followed easily. A corner of the kitchen or living room is often a convenient site and a square kennel or box one and a half times the length and height of the animal makes a suitable nest. A minimum and maximum thermometer fixed inside the kennel permits accurate checking of temperature.

Pups are usually born on 60th to 62nd day; maidens and large litters tend to be earlier. Carrying beyond time I do not usually find serious, but one Boston terrier carried to 71st day and still showed no sign of whelping. Caesarean section was performed.

Whelping

As a general guide, I find that if efforts at labour are fairly frequent, the first pup is born within three hours. If the efforts are strong and sustained the pup may be born well within half an hour. If labour is weak and interrupted the event may drag on for some six hours. This holds good, more or less, for each pup of the litter although the later pups are usually born with less effort. In determining whether whelping is overdue, the important guide in the early stages is not so much the time taken as the effort expended. For example, with a pup at the entrance of the pelvis, it would certainly be overdue if no progress was made after half an hour of labour.

While large litters may be born in a very short time, it is common for the process to extend over a good twelve hours even with a small litter.

The pup is usually presented head first, but hind limbs first is quite frequent, the latter presentation permitting easier birth. Usually a fluid balloon of foetal membranes shows at the vulva. As the pup passes to the posterior part of the pelvic passage, a bulge shows below the anus. The pup then passes down the vagina and comes into view. At this stage the outer sac of the foetal membranes is usually ruptured allowing the allantoic fluid to escape. As a rule the pup is born still attached to the mother by the umbilical cord and enveloped by an inner sac. The bitch normally opens the latter and cuts the former. I consider that where every care is to be given, the bitch should be secured, the sac opened, the cord seized in artery forceps and the pup liberated, leaving the forceps attached to the maternal part of the cord. There is a flush of blood from the cut end of the pup's cord which, if the flow continues, should be crushed by artery forceps. The respiratory passage should be cleared of fluid and the pup kept warm. With the bitch still held the cord is cautiously twisted round the forceps and gentle traction exerted. In less than one minute the complete afterbirth comes away. It may not be possible to secure the foetal membranes at birth but it is desirable that each should be accounted for and removed, if not at each birth, as soon as possible after whelping is complete. If necessary forceps should be passed into the uterus to seize and remove these tissues. The early removal of all afterbirths favours quick involution of the uterus which minimises the risk of puerperal fever. When one or more afterbirths are retained, I endeavour to remove them by pituitrin injections, by dosing with ergot, and eventually, if necessary, douching with zinc sulpho. carb. (one drachm in a pint of water). The removal of afterbirths may be aided considerably by digital manipulations through the wall of the abdomen.

When it is suspected that a pup may be overdue, digital examination by vagina is made with thorough care to ensure asepsis. The subject is secured with its head under the assistant's left arm, his left hand supporting the abdomen and his right hand holding the base of the tail.

When I find efforts at labour are lacking or are weak, I ensure as far as possible that the pup is normally presented, or so presented that expulsion with effort seems possible, and inject pituitrin 1 c.c. (10 international units) subcutaneously every half hour until there are obvious signs of labour. In a course of such injections I have given as much as 6 c.c. of pituitrin to secure four live pups from a Cairn terrier. The injections should not be made intramuscularly, as abscess formation is likely. I do not like to use pituitrin for a first pup, especially if the bitch is a maiden and/or there is a large litter. In such cases rupture of the womb is a grave risk. Pituitrin is particularly useful in bringing a pup from a horn into the body of the uterus and again when a pup just entering the pelvis is delayed. Once the pup has entered the pelvis, considerable aid can be given the bitch by restricting expansion of the abdomen during her efforts at expulsion, and again aid can be given once the head has passed through the pelvis and before it appears at the exterior. The skin over the vagina is pushed back and the head of the pup secured and drawn outwards.

When a pup fails to be born after reasonable time and effort, I consider it a great error to allow the bitch to exhaust herself by continued attempts. The pup should be removed by forceps. This almost invariably results in its death. Any pup malpresented or unduly large may cause a hold up, the first pup being the commonest offender. Very frequently I remove one such pup to have the rest of the litter follow normally. An efficient assistant, suitable forceps, plenty of lubricant (sterile liquid paraffin) and powerful traction are required. With efficient asepsis and good lubrication the risk is trifling. Enormous pups are removed this way either whole or piecemeal. Normally a pup weighs about 1/50th

of the mother's bodyweight: such pups often exceed 1/20th.

Where pups are of little value, I do not hesitate in a case of undue delay in whelping to remove all the litter in this manner. Dryness, contusions and swelling of the vagina are a severe handicap but it is wonderful what benefit results from an occasional injection of 10 c.c. of liquid paraffin.

When one pup has been sacrificed and when it is manifest that the combined efforts of bitch and surgeon will fail to give birth alive to two or more valuable pups which one suspects still remain, Caesarean section is indicated. It is also indicated when one fails to reach either live or dead pups by forceps. In the smaller breeds, pups may be reached in the horn of the uterus and it is not wise to attempt removal until at least the head or the part to be seized has passed into the body of the uterus.

The presence of recently dead pups is strongly indicated by an opaque bottle green discharge. This becomes dark red-brown and foul at a later stage. The bottle green discharge is associated with separation of placenta which, if it occurs when the pup has not yet reached the exterior quickly results in its death. The same discharges are present with retained placenta.

Douching after whelping is not my normal practice but I do so when afterbirths are retained or when discharge is foul. In rupture of the womb there is a hard, tense abdomen and sooner or later there follows the usual febrile syndrome; it is indicated on douching by the passing of fluid into the abdominal cavity. Laparotomy and appropriate surgical treatment is indicated; closing the rupture or hysterectomy. I find rupture most frequent at the anterior extremity of the horns, its most frequent cause being necrotic penetration resulting from sepsis.

In the later stages of parturition, one can manipulate the contents of the abdomen and determine with a high degree of accuracy the presence or absence of further pups. In small animals immediately after whelping the thickened womb and possibly a retained afterbirth may cause confusion and in certain breeds where there has been a large litter, a pup may lie forward under the costal arch and escape detection. An X-ray eliminates this risk. In this connection I had a peculiar experience with a Labrador. She whelped four live healthy pups. Next day I was consulted and removed two very foul dead ones. I learned later that she whelped one live healthy pup seven days afterwards. Another peculiar case came to my knowledge recently. A bitch was mated twice, ten days between the matings. On the 59th day from the first mating she whelped two healthy pups, and six hours later, three hairless specimens. I think from these two cases one may conclude that it is not advisable to permit a repeat mating more than two days after the first.

A percentage of bitches fail to come in pup after mating; these and unmated ones may show false pregnancy with all the signs of being in pup even to the bottle green discharge associated with separation of placenta.

Abortion in my experience is confined to sporadic cases most of which can be accounted for. In sustained losses I have always found the cause to be obvious: distemper, bombing practice, thunder, or some such disturbance. I have no evidence that a *beta haemolytic streptococcus* causes any such losses in my district.

Rearing

It is usually safest to take the new-born pups from the bitch while she is in labour. They are kept warm in a box with a hot water bottle and lightly covered. A temperature of 70° F. should be maintained. If whelping is protracted, they should be suckled at three-hour intervals. When the complete litter has arrived the bitch should have excess hair removed from the abdomen and the mammae washed before being presented with her family. The temperature inside her kennel should not be less than 70° F. for the first four days and for the next eight 65° F. Once the eyes are open and pups can move with some efficiency, a temperature of 60° F. suffices. I tell my clients that if a suckling pup dies within the first four days it is due to lack of heat and/or nourishment; after that it is worms. I am satisfied that one or other of these factors or a combination of them accounts for all heavy losses at this age. There are exceptions—deaths from accidents, deaths from distemper, pups that cannot or will not suckle, weaklings, monstrosities. I have no record of a suckling pup surviving an outbreak of distemper. I have seen a litter of eight pups die of epileptiform fits between the 15th and 18th days. The mother, an immunised animal, showed only mild upset. I have given pups, that show no signs of illness but have been exposed to distemper infection, enormous doses of Burroughs Wellcome serum and have lost every one. I do not intend to enter the conflict about haemolytic streptococci, but I would state that my few investigations show clearly that true or beta haemolytic streptococci are found on the tonsil and vagina of a very large percentage of healthy and, in many cases, newly whelped bitches. They are found in the throat of many newborn healthy pups. In one or two pups from a dead litter they have been found in the spleen. Never have I had a report confirming the presence of beta haemolytic streptococci from the spleens of all dead pups in a litter. It seems strange that this allegedly deadly organism, present in numbers and favourably placed to get access to the cord where its ideal medium is present, does not cause infinitely greater losses than can reasonably be attributed to it by evidence. May I remark, further, that a single dose of penicillin to a newborn pup should give it complete protection from *beta haemolytic streptococcus* infection. A litter seldom dies without the cause being evident.

When conditions are ideal, good, or even passable, the losses in very young pups are trifling.

Dew claws and tails are removed on fifth to seventh day, the wounds being dressed with tinct. ferri perchlor. fort. The eyes are attended to about the tenth day if necessary. After the first few days, worms are the great danger. I have seen a Peke's bowel occluded by masses of ascarids at the seventh day. The dose for such tiny pups is one drop more than the number of ounces of bodyweight of the following: Ol. Chenop. mX, Ol. Ricini $\bar{3}$V, Paraffin liquid $\bar{3}$V. For larger pups, I stock $\frac{1}{8}$ m., $\frac{1}{4}$ m., $\frac{1}{2}$ m., 1 m. and 3 m. chenopodium capsules for, respectively, 10 oz., 20 oz., 2½ lb., 5 lb. and 15 lb. weight. The dose is repeated every 10 to 14 days until no further worms are expelled.

The next great danger period is weaning and usually a change of home. Weaning generally is complete at the end of the seventh week and the pup is often in his new home by the eighth—far too often, long before this. If a town pup is to be inoculated against distemper, I prefer to give Burroughs Wellcome vaccine at the tenth week and virus at the twelfth. This permits the animal to be immune, before he ventures on the street. It also allows him time to die or recover from the effects before the ordeal of replacing his teeth commences.

Feeding

In discussing diet, it is well to establish the ideal diet for the mature animal and the ideal diet for the suckling pup, so that the latter may be changed by easy stages to the former.

At the Royal (Dick) Veterinary College, in investigating the requirements of quarantine dogs, it was found that good

health was maintained over a period of six months by a dog weighing 30 lb., receiving 3½ oz. of horse meat, 6⅔ oz. dog biscuits, which gives the animal some 800 calories. Dechambre in his investigations fed a higher proportion of starchy foods, giving a 30 lb. dog some 1,100 calories.

My criticism of the College diet is that it lacks variety and that the very generous protein allowance would now in most cases be difficult and very expensive to maintain. Dechambre's diet will allow more calories than are required although his animals may have been expending considerably more energy than the confined quarantine dogs of the College. While there is evidence that both these diets are satisfactory, I consider that for a 30 lb. dog, a diet such as follows is more suitable.

Protein	*Fat*	*Carbohydrates*
Meat, 2 oz., or	1 oz.	Biscuits, 3 oz.
Herring, 3 oz., or		Bread, 3 oz.
White fish, 4 oz.		Cooked potatoes and vegetables, 3 oz.

This gives some 900 calories with a nutritive ratio of 1 : 8.

The ideal diet for the suckling pup is its mother's milk, which, according to Linton's "Animal Nutrition and Dietetics" is as follows :—

Protein	*Fat*	*Carbohydrates*	*Ash*	*N.R.*
11	9·5	3	0·7	1 : 2·28

These figures may be taken as an average, though the fat, so far as my knowledge goes, tends to be lower and the protein higher for the first week of lactation; but in both wide variations are recorded, fat being as low as 4·6 per cent. and as high as 10 per cent., and protein from 10 to 14·4 per cent. There is some evidence that protein declines and fat increases as the period of lactation advances, which is what one would expect. In the second week, the fat content is usually above 12 per cent.

Our problem in many cases is to find a substitute for bitch's milk to supplement or replace an unsatisfactory natural source. Fresh egg contains 11 per cent. protein in a most easily digestible form and 10 per cent. fat. In respect of these ingredients it is almost identical to bitch's milk. In practice, egg reduced with equal parts of fresh cow's milk has been found very satisfactory for supplementary feeding and for rearing artificially. Analysis is: protein 7 per cent., fat 7 per cent., carbohydrates 2·24 per cent., with a nutritive ratio slightly wider than 1 : 2. The squeaking and licking pup can usually be saved if fed every three hours during the day and every four at night, and when they have picked up, not infrequently they start to suckle. The hours I suggest for feeding orphans, etc., during the first two weeks are, 1, 4, 7, and 11 p.m., 3, 7 and 10 a.m. After the second week, 7 and 11 a.m., 3, 7 and 11 p.m. Artificially reared pups require regular sponging of the natural orifices.

Artificial feeding is best done by a pipette or spoon. The warm mixture is dropped slowly on to the lower margin of the philtrum (central groove of muzzle); from there it is quickly taken by the tongue. In small pups, 1 to 2 drachms may be given at each feed, but mild tension at the anterior of the abdomen is the best guide for quantity. Hand fed pups often break out in extensive shallow skin pustules.

Normally, it is usual to start pups to lap at the third week and at this age it is important to see that the bitch has refuge from her family. I start them with one part egg, two parts milk and, as soon as they take this well, add finely minced raw meat. At the end of the fourth week, starchy food is included (baby food, bread or fine biscuit meal) but roughage is avoided. Quantities are gradually increased as are the proportions of milk and starch. At the end of the fourth week, two meals a day are given, at the end of the fifth week, three meals, and at the end of the sixth week, four or five meals; by increasing the starch, the nutritive ratio is widened and at the sixth week should be 1 : 3, at which I consider it should be maintained until the pup is some seven to eight months old. From six weeks onwards, a diet such as is indicated by the following diet sheet has proved very successful as a general guide to the laity.

Diet for Rearing a Puppy

8 a.m.—One dessertspoonful of puppy meal, hound meal, bread or cooked cereal to be given soaked in milk.

12 noon.—One large dessertspoonful from each of A, B and C :—

A. Meat.—Cooked or raw beef, pork, mutton, heart, liver, collop, egg, etc., or cooked rabbit, hare, game, fowl, sheep's head, tripe, pluck, fish, black pudding. (A small portion of fat, about one-eighth of the amount of meat, should be included.)

B. Cooked vegetables.—Cabbage, turnip, cauliflower, brussels sprouts, kale, carrot, parsnip, etc.

C. Starchy food.—Hound meat, dog biscuits, bread, cooked potatoes, or cereals.

To this mixture of A, B and C, add half teaspoonful of first quality cod-liver oil.

4 p.m.—Give fresh milk, with or without starchy food, according to appetite.

8 p.m.—One dessertspoonful of raw beef, pork, mutton, heart, liver kidney, collop, cheek, sweetbread, or quarter of an egg. Give a little milk—two tablespoonfuls.

The animal should always have access to fresh, clean water, and should be given a large, soft, fresh marrow-bone, cooked or raw, twice a week.

The quantities of food given must be adjusted according to the size and age of the animal.

The above quantities would suit a fox terrier puppy six to eight weeks old.

As the animal grows older the quantities of food should be increased and the number of meals reduced.

For a fox terrier four months old, three meals will suffice, each double the above quantity—8 a.m., 12 to 2 and 8 p.m.

At six months old, two meals will suffice—at 12 to 2 p.m. about six tablespoonfuls, and at 8 p.m. about two tablespoonfuls.

At one year old, one meal is sufficient, ¾ to 1 lb. of food at 12 noon or later.

The necessity of flesh food is reduced as the animal matures. A well-balanced diet for an adult healthy house dog should contain about equal proportions of flesh, cooked vegetables, and starchy foods. Neither milk nor cod liver oil is necessary or advisable.

Adjustments in the diet may be necessary for various reasons, but care should be taken, (*a*) to avoid feeding adult dogs excessive quantities of proportions of starchy or flesh foods; (*b*) to prevent the proportion of flesh in the diet falling below one-eighth of the ration.

An adult dog requires between 1/20th and 1/30th of his bodyweight of food every 24 hours.

ADDRESSES OF DISEASE-INFECTED PREMISES

The list given below indicates, first, the county in which are situated the premises on which disease has been confirmed, followed by the postal address and date of outbreak.

Sheep Scab:

Lancs.—Robert Laithe Farm, Colne, Lancs. (Sept. 5th).

Yorks, W.R.—Coppy Farm, Cowling, Keighley (Sept. 2nd); Emmott Moor, Cowling, Keighley (Sept. 3rd); Castle Piece, Bradfield, Sheffield (Sept. 9th).

AN IMPROVED TECHNIQUE IN RUMENOTOMY

By

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The writer has for some time felt the need for a technique in rumenotomy which will simplify the operation and dispense with the necessity for a " clean " assistant. Several methods were tried but it was not until three special instruments were devised that a satisfactory technique was arrived at.

The photographs illustrate the instruments and the method employed.

The hook (Fig. 1) is rubber covered to prevent damage to the rumen.

The tube (Figs. 1, 2 and 3) is constructed from a motor car inner tube, size 5½ inches, a section of which is cut about 12 inches in length. Into the lumen of this is inserted a rubber ring which is placed about midway between the ends, leaving one end a little longer. The longer end of the tube is then pulled outside in through the ring. The two ends thus meet and are vulcanised together in this position. The ring is made from a pram tyre about ⅝ inch cross section, and which may be obtained with a wire core reinforcement. The ring is bent into an oval shape, and the inside dimensions are, longer diameter 6¾ inch, shorter diameter 5¼ inch. These may be made slightly larger as desired.

The clamps (Figs. 4, 5 and 6) are made from sheet brass and are 12 inches in length. The arms of the clamp are U-shaped in cross section, and this space holds the rubbers. For these two strips of sorbo rubber ¼ inch thick, 2½ inches wide, and 10 inches in length, are used. Each strip is doubled upon itself along its length and pushed into the U space. The metal is now squeezed in a vice to grip the rubber tightly. The arms now present a smooth rubber surface where they come in contact with the rumen. This was found to be the most satisfactory way to produce a clamp which would hold the rumen firmly but yet be soft enough to avoid damage to it. A screw is provided at either end of the clamp for closing and adjusting tension. All instruments are sterilised by boiling.

TECHNIQUE.—The animal is starved 24 hours before the operation. It is important to keep it tied up during this period. As the rumen gradually empties, pressure is diminished and pain relieved, and the animal will often eat its bedding.

Anaesthesia is produced with 2 per cent. planocaine by local infiltration. It is injected in the usual T manner, the stroke of the T being parallel with and just ventral to the lumbar transverse processes, the upright of the T being along the line of the proposed incision. The anaesthetic is first given subcutaneously. The needle is then introduced into the peritoneal cavity where the stroke and upright of the T meet and about 15 c.c. of anaesthetic injected. To make sure that the needle point is in the peritoneal cavity the syringe should be removed and a hiss of inrushing air will be heard. The anaesthetic is then injected into the muscle along the line of incision. In all, about 100 to 150 c.c. of anaesthetic is used. In thin animals less may be needed, but those with much subcutaneous fat may require more.

The incision is commenced 2 inches below the lumbar transverse processes and midway between the last rib and tuber coxae, and is continued ventrally for about 6 inches. The rumen is grasped and pulled out of the wound as far as possible. A 1-inch incision is made in its upper portion and the hook inserted. This is held and pulled upward by the assistant whilst the incision is extended downwards for about 4½ to 5 inches. The fingers of the left hand are hooked into the lower end of the incision and the rim of the tube introduced into the rumen (Fig. 1). The dorsal part of the rim is entered first. The sides are then squeezed together and will readily slip into the incision whilst the ventral portion of the rim is entered last. The lips of the rumen wound will then lie in close proximity to the sides of the tube and grip it tightly. The pull of the rumen will draw the rim against the skin. A thin rubber sheet with a 6-inch elliptical hole is placed between the rumen and the skin (Fig. 2). Another sheet is placed over the rim and the edges of the tube are doubled back (Fig. 3). The arm lubricated with paraffin is inserted and a search made. When the foreign body has been removed the sheets are taken off and the clamp is applied to the rumen under the rim of the tube (Fig. 4). The tightness is adjusted by means of the thumb screws. The tube is now removed and the lips of the rumen wound cleaned (Fig. 5). Using No. 1 or No. 2 chromic catgut and a straight, round-bodied needle the rumen wound is closed with a Connell suture which is overlaid with a continuous Lembert. The latter finishes at the top where it is tied to the beginning of the Connell (Fig. 6). The exposed rumen is swabbed and the clamp removed. Just before returning the rumen to the abdomen the suture line is dressed with penicillin in oil. The peritoneum and internal oblique muscles are drawn together with a continuous No. 3 chromic catgut suture. The skin and external oblique are caught up together with interrupted nylon eversion sutures.

Although the symptoms produced by penetration of the reticulum with a metallic object are well known, the writer believes it will not be out of place to add a few observations on the condition.

HISTORY.—Often the owner will describe the cow which was normal when last seen, coming in to milk well behind the others, walking with her back arched and grunting as she moves. Although she may have been milking well previously, there is a sudden drop in yield and in severe cases there may be none at all. To the owner she may appear to be " bound up " as only small quantities of faeces are voided. On enquiry into her past history she may be found to have had one or more previous attacks. Sometimes the onset of an attack may be noticed by the owner or cowman. The sudden sharp pain may cause the animal to appear startled and kick forward at its belly. However, this kicking may pass unnoticed and does not generally recur unless deeper penetration takes place. The animal may be found recumbent or even stretched out in a kind of fit, these symptoms sometimes occurring when the pericardium is penetrated.

SYMPTOMS.—In uncomplicated cases the pulse rate is normal or slightly raised. When the pericardium is penetrated the pulse may be over 100. The " splash " does not develop until a week later and in conjunction with this the " corded " jugular vein appears.

Temperature.—In the initial stages when the peritoneum has been penetrated the temperature is elevated up to 104° or 105° F. This varies with the degree of penetration and if, as often happens, the peritonitis remains localised, the temperature drops to normal within a few days. With a moderate amount of peritonitis a temperature of 102·5° to 103·5° F. is usual. If the foreign body becomes embedded in the wall of the reticulum without penetrating the peritoneum, the temperature is not raised. This occurs more frequently on the right wall of the organ where the musculature appears to be thicker.

Respiration.—If pain is severe, respirations are rapid and

Fig. 1.

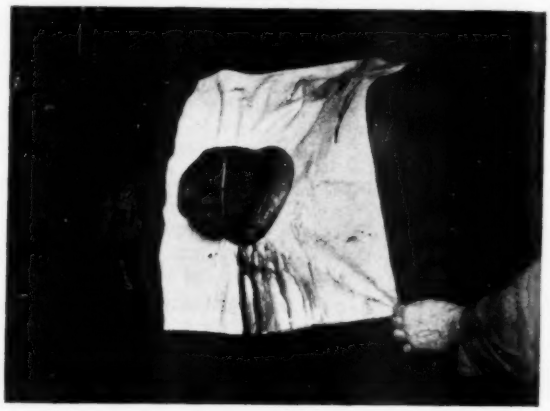

Fig. 2.

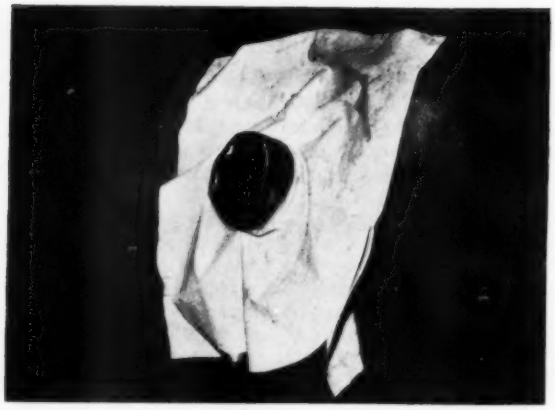

Fig. 3.

Fig. 4.

Fig. 5.

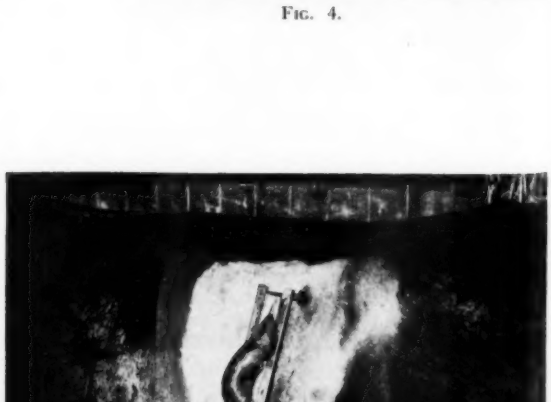

Fig. 6.

shallow. Often the thorax is fixed and abdominal breathing occurs.

Posture.—The animal stands with its back elevated, the highest point being about the middle of the thoracic vertebrae. This produces a typical hump. The well-known test is to pinch the skin over this area thus causing depression of the back and eliciting a short, painful grunt. Sometimes in chronic cases this will escape notice unless the ear is held close to the animal's head. There is often a marked restlessness when the back is depressed. The animal moves about from side to side and may even drop on to its knees. After one or two attempts at this have been made, the animal will earn to resist depression and the back will remain humped.

The head and neck are held outstretched, *i.e.*, parallel with the ground. The eye has an anxious expression and the ears are held back. Severe tympany is not a feature of the condition and the writer has never seen the so-called " peritoneal tympany " described by some authors. In the first stages of peritonitis the abdominal muscles are tense and any gas present in the rumen becomes evident because the increased intra-abdominal pressure distends the hollow flank region. Depression of this area with the finger tips soon meets with solid resistance from the ruminal contents. A feature often noticed at this stage is a peculiar tremor of the flank region. Later, as the rumen empties, the flank becomes completely hollow and the evidence of gas disappears. After fasting the patient appears to be much better but as the rumen becomes full again pain returns.

If the animal remains recumbent for long periods and s unwilling to rise on persuasion, one can be fairly sure that the pericardium has been penetrated. When this happens pain at first is intense, but later there is an outpouring of fluid into the sac, pain diminishes greatly and the appetite will improve. However, it is not long before the gradual increase of fluid causes cardiac embarrassment and the patient becomes distressed. It is then that oedema of the throat and brisket appears. Occasionally penetration of the myocardium will cause profuse haemorrhage into the pericardial sac and death may occur from syncope.

The Metal Detector.—For several years the writer has used an army mine detector on cases of suspected foreign body. The instrument in use at the present time is the U.S. Army pattern and this has the advantage that in addition to the usual audible signal, a meter is incorporated which gives a visual indication when metal is present. The instrument is highly sensitive and will give a reading in the presence of small chips of metal resembling iron filings, on the floor of the reticulum. Its use therefore demands considerable care and the strength of the reading must be taken into account. In the writer's opinion the use of the metal detector as an aid to diagnosis is strictly limited. However, it possesses a few advantages, which are as follows: In doubtful cases with a positive reading one can be assured that something will be found unless, of course, complete penetration has occurred. On the other hand, should no reading be obtained, the doubtful case will not be operated on. The detector will give an indication of the position which the foreign body occupies in the reticulum. Free objects are generally midline and posterior to the xiphi-sternum. Penetrating objects may be left or right of midline or just anterior to the xiphi-sternum. The detector may be used after the manual search has been made to make sure everything has been discovered. It might be mentioned that at this stage a small permanent magnet is useful for picking up the odd bits.

Discussion.—The writer has found that by adopting the technique described above, the operation of rumenotomy is much simplified and can be carried out under the most adverse conditions with the minimum of help. He has also abolished post-operative peritonitis, as trauma of the rumen has been reduced to a minimum. When performing a rumenotomy one can at least assure the owner that whatever happens the animal will be no worse off from the effects of the operation.

Summary

A rumenotomy technique using three special instruments is described. The writer's observations on the effect of the penetration of the reticulum by a metallic foreign body are recorded. The use of a metal detector is mentioned.

Pavlov's Work on Conditioned Reflexes

Dr. E. O. Adrian, Professor of Physiology in the University of Cambridge, contributing the opening article in *The British Medical Journal* of September 10th, on the centenary of Pavlov's birth (in Ryazan, a district town in Central Russia), writes: "From 1905 onwards Pavlov settled down to investigate the conditioned reflexes, and for the rest of his life he was constantly at work on them. We do not yet know what neural processes take place in the brain when a new habit is formed, but what we do know about animal and human behaviour has been enormously extended by what Pavlov found out. He used a new method of experiment and a new way of treating the results. Thorndyke had studied the associative processes in animals by experiments in which the solution of a simple problem was rewarded by food. His results were published in 1898 in his book, *The Animal Intelligence*, which is now one of the classics of experimental psychology. Pavlov studied the formation of reactions associated with feeding, but he deliberately excluded the subject-matter of psychology. He believed that the physiologist ought to keep to his proper sphere, that nothing but confusion would come if he began to speak or think of learning, of fears and hopes, success or failure. He must confine himself to an objective analysis of the external stimuli and of the animal's behaviour. He must 'adhere strictly to the physiological point of view, investigating and systematising the whole subject by physiological methods alone.' This is easier said than done: the exclusion of the familiar terms which we use to describe our own behaviour often seems to involve a complex restatement in which half the picture is left out. But Pavlov adhered strictly to his principle, and was justified by the discoveries which it brought. He set himself to study not 'learning' but the 'formation of conditioned reflexes,' and he succeeded in demonstrating many of the rules which govern their formation.

"Pavlov has been praised or blamed because his thesis could be taken to mean that men are machines and should be treated as such. Naturally he wanted to see how widely his physiological net could be cast, and he was human enough, one might almost say naughty enough, to enjoy the reaction of his hearers when he discussed religion as an example of the social conditioned reflexes. But his real concern was with the experiments he was making to cover the borderline between innate and acquired reactions. The value of his way of approach is shown not only by what he himself found out but by the whole development of behaviour studies in the past 30 years.

"There is no doubt at all about the value of the method. The conditioned reflex is now used as one of the standard tools for investigating the capacity of the nervous system. It can be used to study the range of sensory discrimination, the effects of cerebral injury, etc., for Pavlov has shown how conditioned reflexes can be formed and kept in being, and for many purposes that is enough."

* * * * *

FOWL PEST IN ORKNEY

The Ministry of Agriculture and Fisheries announces that in view of outbreaks of fowl pest which have recently occurred in the Orkney Islands, an Order has been made prohibiting the movement of live poultry from the Orkney Islands to any other part of Great Britain.

The Orkney Correspondent of *The Times* states that it is thought that migrating birds may be the cause of the outbreak of fowl pest which seriously threatens Orkney's £750,000 egg industry. Three further cases, making six in all, were confirmed during the week-end, the latest at Hoy. Unofficial estimates put Orkney's total losses between 2,000 and 3,000 birds. Ministry of Agriculture officials are working continuously dealing with suspected cases.

CLINICAL COMMUNICATION

ACTINOMYCOSIS IN A LABRADOR BITCH

H. FORSYTH, M.R.C.V.S.

Lechlade, Glos

Subject.—A six-year-old yellow Labrador bitch, excessively fat but a keen worker.

History.—The bitch was first examined on December 9th, 1948. When she was taken shooting a month earlier, the owner had noticed that the animal was lethargic. Since then lethargy had been continuous and the appetite, previously good, had deteriorated and the animal was drinking more water.

Symptoms.—Temperature 103°, conjunctivae slightly injected, tongue rather furred, tonsils and throat apparently normal, bowel action normal. Deep anterior palpation of the abdomen caused discomfort, but there was no tenseness in the area. No uterine enlargement or alteration in the size of the kidneys could be found, although the heavy build of the animal rendered accurate estimation of the character of these organs difficult.

Diagnosis.—No definite diagnosis could be made.

Treatment.—A short course of M. & B 693 was prescribed.

Course.—The next day the temperature was normal and the conjunctivae were normal in colour. The animal was still lethargic and the appetite was capricious. Three days later the condition was unchanged, and the temperature was 102·8°. A further course of M & B was given, together with Crooke's Collotone.

On the 19th the owner asked for the animal to be destroyed as its condition had worsened steadily over the last three days. Thirst had been insatiable with vomition of all water drunk. The owner had tried forced feeding but only glucose-water had been retained; the bitch had lost weight.

Post-mortem Findings.—The central lobes of the liver particularly the left central lobe, contained numerous small nodules, giving a tuberculous appearance to the organ. On incision some nodules exuded a milky pus. The abdominal cavity contained a quantity of amber-coloured fluid and the mesentery was stained a peculiar orange brown colour. The fluid contained very small white granules and these gave a gritty feeling to the peritoneal surface. The spleen was enlarged and friable. Other organs appeared normal.

Sections of liver, kidney, lung and spleen were fixed and sent to the A.R.C. Field Station at Compton for histological examination. This examination revealed lesions associated with actinomycosis.

Discussion.—As this condition did not appear to have been reported in this country, it was decided to search the literature and carry out further histological work before publication. In the meantime, however, an account by Ginsberg & Little (1948) was published giving both the bacteriology and pathology of two cases in Britain, thus making a detailed account unnecessary—hence this contribution is restricted to a clinical communication.

A particular interest was taken in this case because one of the bitch's puppies had also died from a wasting disease, but this had been shown to be fibrosarcoma (Baxter & Holman, 1948).

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Ginsberg, A., & Little, A. C. W. (1948.) *J. Path. Bact.* **60.** 563.

REVIEW

[Experimental Air-Borne Infection. By Theodor Rosebury. Pp. xi + 222 (figs. 45). Price 22s. net. Baillière, Tindall & Cox, 7 & 8, Henrietta Street, London, W.C.2. British agents for the publishers, the Williams & Wilkins Company, Baltimore.]

During the war, a large series of experiments on the importance of air-borne infections was undertaken both in America and in this country. These investigations necessitated the elaboration of special apparatus for the production of mists of droplet nuclei in which the concentration of infective particles could be carefully controlled whilst the personnel handling the apparatus were protected from accidental infection. Once the technical difficulties in this sphere had been overcome, a vast field was opened which was first exploited for the war effort but is now yielding important results in the control of air-borne epidemics.

The book under review recounts the progress of an investigation undertaken at a U.S.A. military station between 1943 and 1945. The data have been collated under the editorship of Dr. T. Rosebury who acknowledges the part played by a group of co-workers.

The first part of the book describes the special apparatus which was built for the exposure of small animals to air-borne particles or dangerous pathogens. There are numerous photographs and figures which will enable other investigators to set up the somewhat elaborate chamber which was eventually selected. The main features are the careful control of the atomiser for the production of the mists so that reproducible results could be secured and the institution of safety devices to protect the workers. A large number of nebulisers were tested and their performances are set out in great detail: this information is of great value especially when taken in conjunction with similar data supplied in the recent monograph published by the M.R.C.*

The second part of the book is concerned with an assessment of the number of particles required to induce pulmonary infections in animals and with an analysis of the variations which may arise. The experimental data show that if a satisfactory impinger device is used to control the air flow and to permit sampling of the mists, the cloud remains reasonably uniform in both time and space. The largest errors are due to biological variability particularly in the respiratory volume of animals, but these factors are not of sufficient magnitude to invalidate the experimental results. The respiratory infections studied by the technique were *Br. suis* in guinea-pigs and mice, *Malleomyces mallei* and *M. pseudomallei* in hamsters, *Past. tularensis* in mice and rats, meningo-pneumonitis virus in mice, hamsters and cotton rats and psittacosis virus in mice, guinea-pigs, hamsters and cotton rats.

The book is essentially a description of laboratory techniques and as such is essential for workers in the specialised field of experimental air-borne infections. The general reader will not find any account of the practical application of these methods in the control of aerial contaminants.

* Studies in Air Hygiene, 1948. Medical Research Council Special Report Series, No. 262.

Weekly Wisdom

Hard work is still the road to prosperity and there is no other.
—Benjamin Franklin.

ANNOTATION

AIR-BORNE INFECTIONS

During the past ten years there have been substantial advances in our knowledge of air-borne infections. The main trend of modern investigations has proceeded along two lines, *viz.*, (*a*) a study of the pathogenesis of upper respiratory diseases induced by the exposure of experimental animals to artificially created mists of bacteria and viruses and (*b*) the redistribution of pathogenic organisms into the atmosphere and their control by physical or chemical means. These enquiries have involved the elaboration of special apparatus and new techniques some of which are, at present, applicable only to laboratory studies, but already our knowledge of suitable methods for controlling cross-infections in operating theatres, hospital wards, schools, etc., has yielded results of some practical value and will doubtless lead to further improvement in air hygiene. The new fields which have thus been opened were exploited during the war but much of the information obtained could not be made available until hostilities ceased. Recently, however, two reports have been issued, *viz.*, Studies on Air Hygiene (1948) and the book by Rosebury (1947) reviewed elsewhere in this issue, which summarise parts of the investigations undertaken by teams of workers in this country and in the U.S.A.

Distribution of Air-borne Particles.—The earlier methods of determining the bacterial population of the air were based on the exposure of Petri plates containing a suitable nutrient medium. Investigations of this type are of some value in estimating the number of particles which are likely to settle out by gravity. They will thus indicate the weight of infection to which, for example, an open wound will be exposed from infected dust particles or coarse droplets. These methods, however, are not suitable for the detection of fine air-borne droplet nuclei which may be of significant importance in cross-infections.

Bourdillon, McFarlan & Thomas (1948) found that in operating theatres the numbers of colonies per plate per minute exposure varied from 0·05 up to 4·7. These figures are not dissimilar from those reported by Devenish & Miles (1939) and Hart (1939).

The numbers are much higher in hospital wards. Thus Cruickshank & Muir (1940) who used *Strept. pyogenes* as the indicating organisms showed that when blood plates were exposed for two hours as many as 90 colonies could be detected. The importance of air-borne streptococci was demonstrated by Allison & Brown (1937) who observed that haemolytic strains isolated from the air were identical with those causing infection.

Many of these organisms are shed into the air by nasopharyngeal carriers especially during talking, coughing and sneezing. Bourdillon, Lidwell & Lovelock (1942) demonstrated that in a closed room, a sneeze caused the emission of about 100,000 bacteria-carrying particles. The spray is made up of heterogenous particles some of which are relatively large and soon settle out by gravity whereas others are much finer. The latter by the rapid evaporation of surface water are converted into droplet nuclei which remain suspended in the air for long periods: special apparatus described in the next section are required to detect this type of particle. The coarse particles settle out rapidly. It has been noted by Hare (1941) that when shed by a nasopharyngeal carrier they are rarely carried more than 1 foot.

At first sight it would appear, therefore, that at a distance the greatest danger arises from droplet nuclei. This is probably true of a relatively dust-free atmosphere but under ordinary conditions redispersion of bacteria by dust particles presents a serious problem, since dust may contain large numbers of pathogens. Hare (1941) showed that human beings who are carrying haemolytic streptococci in their nasopharynx were a source of danger not only because of the contamination of wounds, etc., which might arise directly from air-borne particles expelled from the mouth and nose, but also indirectly through the deposition of these particles on bedding, floor, clothing, etc., whence they were redistributed in the air attached to dust particles.

Thomas (1941) found 17 million β haemolytic streptococci per g. in dust in a ward where throat cases were housed. Blankets and bedding are particularly liable to become heavily contaminated (Hamburger, Puck, Hamburger & Johnson, 1944). When air samples are taken in hospital wards during the process of bedmaking, large numbers of bacteria are distributed into the air. They may reach 2,000 per cubic foot and many of them may be potential pathogens. Wright, Cruickshank & Gunn (1944) recorded up to 1,940 organisms per cubic foot during bed-making whilst Hamburger, Puck & Robertson (1945) found 157 per cubic foot in scarlet fever and measles wards. Bacteria and viruses if rapidly dried retain their activity in dust, etc., for considerable periods. Thus Garrod (1944) recorded the survival of haemolytic streptococci in dust for six months when protected from light and his results have been generally confirmed by other workers. Edward (1941) recorded influenza A virus in dried films for at least a week. The shorter period of survival in this case conforms with the greater fragility of most viruses as compared with bacteria.

The finer particles are also of significance. The droplet nuclei which remain suspended in the air are not readily detected by the crude method of exposing Petri plates and special devices have been constructed whereby air-borne bacteria have been concentrated on a small area of culture media. The Wells centrifuge which is used on a wide scale in America (Wells, 1937) is a form of spinning cylinder coated with a suitable nutrient medium. A measured volume of air is drawn through the apparatus and the organisms are ejected by centrifugal force on to the liner which is subsequently incubated. In this country the slit sampler elaborated by Bourdillon, Lidwell & Thomas (1941) has proved of great value. A measured volume of air is drawn through a fine slit by a suitable pump. The organisms suspended in the air impinge on rotating Petri plates containing agar and are deposited uniformly over the whole surface. Much of the modern information on the distribution of air-borne particles has been gained by these devices.

Bacteria and viruses dispersed as mists of fine particles of not more than 5 mμ in diameter are now employed for the experimental study of respiratory tract infections. A wide variety of apparatus has been constructed for the production of these mists. Most of them depend on the dispersion of liquids into droplets by a high-speed jet of air coupled with a suitable baffling system to trap the coarser particles from the droplet nuclei formed by the rapid evaporation of water from the surface of the finer particles (Edward, Elford & Laidlaw, 1943; Bourdillon, Lidwell & Lovelock, 1948; Rosebury, 1947).

The exposure of animals to artificial mists of infective agents in which the bacteria or virus are adherent to or enclosed within particles of 5 mμ or so in size has shown that infection is readily induced by pathogens which have pneumotropic affinities. Mice have been infected in this way by influenza virus (Loosli, Robertson & Puck, 1942; Edward, *et al.*,

* Medical Research Council Special Rept. Series, No. 262. H.M. Stationery Office.

1943; Robertson, Puck, Lemon & Loosli, 1943; Wells & Henle, 1941; Henle & Zellat, 1941) and by a variety of bacteria. Andrewes & Glover (1941); Glover (1941); Bourdillon and Glover (1948) have elaborated apparatus for the study of air-borne infections in ferrets to determine the relative importance of large and small air-borne particles. The use of U-ducts permitted a complete separation of direct "projectile" particles from droplet nuclei: moreover, the weight of infection could be controlled with reasonable accuracy. Ferrets affected with influenza virus and exposed to a mist of streptococci can acquire a heavy streptococcal infection of the nose and turbinates as a result of inhaling about 1,500 fine particles of about 5 mμ diameter each containing one or two streptococci, in the course of an hour.

It has also been shown that rabbits are readily infected with fine mists containing tubercle bacilli (Wells & Lurie, 1941; Radcliffe & Wells, 1948). A pulmonary infection can also be induced in mice in a similar manner (Glover, 1944). These methods have been of value in pursuing means of preventing air-borne infections.

The problems of air disinfection are complex since they involve not only the inactivation of air-borne particles which may be protected with a coat of mucus and may be transported over considerable distances by air currents, but also the prevention of contamination from the more resistant particles disseminated from floors, bedding, clothing, etc. The most potent agents are direct sunlight and adequate natural ventilation: the former acts by its high bactericidal activity and the latter by a rapid dilution of infection. Unfortunately, conditions in cities are such that neither of these factors can operate with maximum efficiency. Many investigations have, therefore, been undertaken to reinforce the effects of natural ventilation.

Ultra-Violet Light.—The two factors of greatest importance in determining the efficiency of ultra-violet light as a bactericidal agent are humidity and dust particles. When influenza virus is sprayed into a still atmosphere under suitable conditions of humidity, the virus is easily killed by ultra-violet light (Edward, Lush & Bourdillon, 1943). At least 90 per cent. and probably more of the influenza virus is killed by exposure for six seconds at a distance of 2 cm. from a Hanovia lamp. The efficiency of ultra-violet light shows a substantial decline, however, as the humidity increases. Thus Luckiesh & Holladay (1942) reported a fall of about 2·22/1 for a range of dry air to very moist atmosphere, whilst Lidwell (1946), using salivary organisms, found a similar increase in survival rate with increased humidity. The quantitative effects of ultra-violet light have been studied by Wells (1942, 1945), by Lidwell (1946) and others.

The employment of ultra-violet light outside carefully controlled laboratory conditions raises many problems. This method is very efficient when directed against fine particles floating in a dust-free atmosphere, but in crowded rooms the viruses or bacteria are often adherent to or even enclosed in coarse particles of mucus or dust. Under these conditions it is difficult to produce a concentration of ultra-violet radiation which will be reasonably effective and at the same time avoid undue exposure of personnel. Bourdillon & Lidwell (1948) could not obtain an over-all reduction of more than 20 per cent. in bacterial counts in certain military barracks whilst in hospital wards the results were little better. Where conditions are more favourable, however, ultra-violet light alone can be reasonably effective.

In America considerable success has been reported with ultra-violet light installed in hospitals, animal houses, etc. Hart (1941) reported that the majority of blood infections occurring in operating theatres arose from organisms shed from the nose and throat. The installation of ultra-violet apparatus offered a simple and effective method of eliminating this source of danger. Robertson & Doyle (1942) in an attempt to protect babies in maternal blocks from air-borne infection stated that ultra-violet light was effective only if conditions of maximum intensity of radiation and absence of air currents were observed. The units were therefore located over the doors of cubicles where exposure to intense radiation was of very short duration.

Ultra-violet light may be of value in controlling tuberculosis. Lurie (1944) found that rabbits infected by the respiratory route with *M. tuberculosis* disseminated the bacilli and infected other rabbits in the animal house. The introduction of ultra-violet units, however, resulted in a substantial reduction in cross infection. Thus in the irradiated room no cases were detected in the rabbits whereas in the control room 73 per cent. contracted infection.

Another line of attack is by means of chemical disinfectants. The agents may be dispersed as fine mists either by heat or by suitable nebulisers. As with ultra-violet light the efficiency of chemicals may be considerably reduced if the atmosphere is heavily laden with dust. The maximum efficiency is secured when bacteria are suspended in relatively dust-free conditions at a temperature below 80° F. and at a relative humidity of 45 to 70 per cent. It is thus seen that unlike ultra-violet light a high humidity is necessary if loss in efficiency is to be avoided. Chemical methods are especially valuable where abnormal contamination exists but the apparatus needs constant attention if breakdowns are to be avoided. A number of substances have been used, each of which has its advocates. The following description covers the more important of these agents.

Hypochlorous Acid and Hypochlorites.—Sodium hypochlorite sprayed in dilute aqueous solution is readily available and is reasonably cheap. It is now known that when dispersed as a fine mist the bactericidal action is due to a gaseous agent (Pulvertaft, Lemon & Walker, 1939; Baker, Finn & Twort, 1940; Masterman, 1941; Baker & Twort, 1941; Twort & Baker, 1942; Elford & van den Ende, 1945; Lidwell & Lovelock, 1948). The simplest method is to expose trays of bleaching powder to atmospheric CO_2 under conditions of high humidity (Lidwell & Lovelock, 1948). Elford and van den Ende (1945) made a careful study of the influence of humidity and found that the most effective range was from 50 per cent. to 90 per cent. When sodium hypochlorite was sprayed into the air so that a concentration of 0·1 to 0·3 parts per million of available HOCl at a relative humidity of 70 to 90 per cent. was achieved, a high bactericidal action was noted provided the organisms were not protected by dust. If hypochlorite is used as a spray, care must be taken in the design of the atomiser which is used since Pulvertaft (1944) has drawn attention to the injurious effect of large droplets on certain fabrics. Bourdillon, *et al.* (1942) have reported that practically all the organisms emitted by sneezing in a closed room are destroyed by 1 per cent. sodium hypochlorite sprayed to give a concentration of 2·1 cm. per thousand cubic foot. Influenza virus and *Strept. salivarius* are very sensitive to hypochlorous acid and kills of from 90 to 99 per cent. can be achieved at a concentration of 1 : 800,000 (Edward & Lidwell, 1943).

Lactic Acid.—Another cheap and efficient chemical aerial disinfectant is lactic acid. An effective concentration can be obtained by vaporising the acid on a hot plate (Lovelock, Lidwell & Raymond, 1944). The bactericidal action reaches a maximum at a relative humidity of 60 to 85 per cent. and at concentrations of acid vapour in excess of 200 mμ g. per cubic foot of air, but a concentration of 100 μg. is quite useful. There is a practical difficulty in using lactic acid vapour arising from the very steep slope of the killing curve

below a concentration of 100 μg. per cubic foot and a slightly irritant effect of the mist when the concentration is in excess of 150 μg. (Lidwell, Lovelock & Raymond, 1948).

Propylene glycol.—In America a large amount of work has been devoted to the properties of propylene glycol (Harris & Stokes, 1942; Puck, Robertson & Lemon, 1943). Puck *et al.* (1943) have observed that at temperatures below 80° F. and at a relative humidity of 45 to 70 per cent. the lethal effect is most powerful. Propylene glycol has the advantage that it is as effective against bacteria in saliva as against organisms suspended in broth but its efficiency is much diminished by dust. The concentration needed to free air from the majority of suspended bacteria ranges from 1 g. per 5×10^3 to 1 g. per 2×10^7 c.c. of air: the latter concentration will kill pneumococci. Propylene glycol has been used experimentally against influenza virus sprayed into the air. Thus Robertson, Loosli, Puck, Bigg and Millard (1941) found that one volume per 10^7 was sufficient to prevent infection of animals exposed to air-borne particles while Henle & Zellat (1941) recommended concentrations of 1 : 200,000 to 1 : 1,000,000. In view of the promising results of experimental work propylene glycol has been employed for the treatment of air in hospitals, schools, etc. Stokes & Henle (1942), Harris & Stokes (1942) reported that when vaporised continuously at a concentration of 3×10^7 in children's wards, the incidence of respiratory infection was reduced considerably. Apparatus has now been devised which will emit large volumes of propylene glycol, so that the air in whole buildings can be charged with the mist: moreover special automatic stabilisers have been incorporated whereby the concentration is maintained at a desired level. Pulvertaft (1944) recommended a combination of hexylresorcinol and propylene glycol. Mists prepared from these chemicals are quite effective against dust-borne organisms up to half an hour after the necessary concentration has been achieved: moreover, such mists have a relatively long life. The chemical can become attached to the surface of walls and ceilings whence it is redischarged into the air and the effectiveness of the mist is thus prolonged.

Dust-Borne Particles.—It will be clear from the preceding sections that all the methods so far described have a restricted efficiency against infective particles from dust, bedding, clothing, etc. During the war, considerable ingenuity was shown in combating these sources of infection. Notable advances were made by van den Ende, Lush & Elford (1940) who discovered that spindle oil possessed high dust laying powers. When spread in a thin film over wooden floors or linoleum the dust particles are "fixed" and are not disturbed by walking or sweeping. Numerous trials have demonstrated a remarkable reduction in particulate matter in the air of wards, etc., treated with spindle oil. The value of this method has been confirmed by many workers (van den Ende & Spooner, 1941; Wright, *et al.*, 1944; Loosli & Robertson, 1945; Puck, Hamburger, Robertson & Hunt, 1945).

Blankets, clothing, etc., can also be treated with oil during the process of laundering. Fabrics so treated do not feel "oily" to the touch and are indistinguishable from untreated garments but the shedding of bacteria is greatly diminished. The dangers of cross-infection which may arise from untreated fabrics have been stressed by Hamburger *et al.* (1944) and Rowntree & Armytage (1946). The usual methods of laundering may be quite inadequate in sterilising soiled bedding, etc., since Colebrook, Clark, Gibson & Todd (1944) have recovered pathogenic organisms from fabrics freshly returned from the laundry. The use of spindle oil in hospitals, etc., has resulted in a substantial reduction in air-borne bacteria and in cross-infections (van den Ende & Thomas, 1941; Loosli, Wise, Lemon, Puck & Robertson, 1946). Loosli *et al.* (1946) have advocated triton oil emulsions as a routine laundering procedure. Puck *et al.* (1945) have recommended a combination of oiling the floor with the liberation of triethylene glycol vapour as very effective in reducing cross-infections. The application of oil to bedclothes during laundering presents many technical difficulties but satisfactory methods have been evolved and are described by Harwood, Pownley & Edwards (1944) and by Puck, Robertson, Wise, Loosli & Lemon (1946).

The application of knowledge acquired as a result of laboratory studies and small-scale trials in hospitals, etc., to conditions of veterinary practice is not yet clear since the sterilisation of air is much more difficult when animals are being handled. Probably the avoidance of air-borne contaminants in operating theatres offers the most useful field for the employment of one or more of the measures which have been described. In view of the part played by dust-borne organisms in spreading infection, the treatment of floors with spindle oil is a cheap and simple method of reducing this source of contamination. If these particles are kept within reasonable bounds ultra-violet light or chemical disinfectants will be capable of reducing the bacterial population to a low figure. At the same time the hair and skin are constantly shedding fresh particles into the air. For this reason the substantial reductions which have been secured in hospital theatres can scarcely be achieved in the veterinary operating rooms.

Cross-infections from canine and feline upper respiratory diseases in waiting rooms and boarding kennels are a constant source of anxiety. The oiling of floors together with the introduction of ultra-violet elements therefore merits consideration. The initial cost of the latter is high but running expenses are relatively low. A simple heater vaporising lactic acid or propylene glycol can be recommended only if it is provided with a device to maintain the mist at a predetermined level and thus avoid concentrations which might be irritant.

R. E. G.

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NOTES AND NEWS

Diary of Events

Sept. 22nd.—Meeting of the Western Counties Division, N.V.M.A., at Exeter (Royal Clarence Hotel), 2 p.m.

Sept. 22nd.—Special Meeting of the South-Eastern Division, N.V.M.A., at Maidstone (Royal Star Hotel), 6 p.m.

Sept. 23rd.—Meeting of the Biochemical Society at Leeds (Department of Biochemistry, School of Medicine), 11 a.m.

Sept. 27th, 28th and 29th.—Meetings of **Council, R.C.V.S.**, at 10, Red Lion Square, W.C.1.

Sept. 27th.—Summer Meeting of the East Midlands Division, N.V.M.A., at Messrs. Boots Hill Farm, Thurgarton, Notts., 12.30 p.m.

Sept. 27th.—Meeting of the West of Scotland Division, N.V.M.A., at Glasgow (North British Station Hotel), 2.30 p.m.

Sept. 28th.—Meeting of the Midland Counties Division, N.V.M.A., at Droitwich (Raven Hotel), 2.30 p.m.

Sept. 30th.—Meeting of the South Wales Division, N.V.M.A., at Cardiff. (*See Notice*).

Oct. 7th.—Extraordinary General Meeting of the Royal Counties Division, N.V.M.A., at Reading (Caversham Bridge Hotel), 2.30 p.m.

N.V.M.A. Committee and Council Meetings

The following are the arrangements for meetings of Committees and Council of the Association to be held in London in November:—

Tuesday, November 15th:
11 a.m.—Parliamentary and Public Relations Committee.
2 p.m.—Organising Committee.
4.15 p.m.—Home Appointments Committee.

Wednesday, November 16th:
10 a.m.—Veterinary State Medicine Committee.
2 p.m.—General Purposes and Finance Committee.

Thursday, November 17th:
11 a.m.—**Meeting of Council.**

Friday, November 18th:
10.30 a.m.—**Special Meeting of Council.**

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PERSONAL

Births.—Hall-Patch.—On September 5th, 1949, to Margaret and Peter K. Hall-Patch, M.S.R.C.V.S., a son.

Lawfield.—On September 9th, 1949, at Stella Maris, Cambridge, to Joyce, wife of F. Geoffrey Lawfield, a son—Michael Anthony.

Westcott.—On August 23rd, 1949, at Lagos, to Gillian and Edward Westcott, M.S.R.C.V.S., a third son (Simon Murray).

Yeoman.—On September 10th, 1949, at University College Hospital, London, to Myrtle (Johnny) (*née* Rowley), wife of Guy H. Yeoman, M.R.C.V.S., a son.

. . . .

Marriage.—Porteous—Nicholson.—On August 22nd, 1949, at St. Andrew's Parish Church, Penrith, Alexander John Porteous, M.R.C.V.S., son of the late John Porteous and of Mrs. Porteous, 30, Leamington Terrace, Edinburgh, to Joyce Edna, daughter of Mr. and Mrs. Roland Nicholson, Castlegate, Penrith.

. . . . . .

Dr. F. H. Manley, Professor of Veterinary Medicine in the School of Veterinary Medicine, Alabama, U.S.A., is in this country, visiting various schools and institutes.

* * * *

No. 1 Cavalry Mobile Veterinary Section, Royal Army Veterinary Corps

This section, which saw active service in Palestine, Egypt, Syria, Italy and Austria, from 1938 until 1945 when it was disbanded, had a unit flag which is now in the possession of Major A. V. Franklin, who commanded the unit from 1940 to 1943.

The President of the Royal College of Veterinary Surgeons has been approached by Major Franklin and has agreed that the flag shall be accepted by the Royal College for safe custody and it is proposed formally to hand the flag over to the President and Council at 2.15 on Thursday, September 29th, at 10, Red Lion Square.

If any officer or other rank who served with this unit would care to attend at the brief ceremony would he please inform the Registrar, when arrangements will be made for seating.

It is interesting to note that this section embarked for Palestine late in 1938 to give veterinary attention to the "Greys" and "Royals" which were then cavalry regiments on active service in that country. In 1940 the section moved to Egypt and was concerned with the Polish Carpathian Brigade and with mule companies which were forming for the Greek Campaign. In 1941 a move took place to Syria with long treks across the Desert.

In 1943 it again returned to Egypt for embarkation for the Sicily landing, and then served throughout the Italian campaign with the 8th Army as an advanced veterinary unit dealing with the many mule companies operating in the line. (The Registrar, R.C.V.S. vividly remembers the mountainous type of country in which these companies had to operate during the war.) It is understood that more than once they were visited by Field Marshal Montgomery on his coming up to various sections of the line.

After the break through in Italy the unit finally ended in Austria and at the time of its disbandment it is understood to have had members who had seen continuous service in the unit from Palestine onwards.

R.S.P.C.A. CENTRE AT AIRPORT

The R.S.P.C.A. has leased from the Ministry of Civil Aviation two acres of ground at London Airport for the purpose of setting up an animal reception centre and hospital with a service embracing quarantine kennels for dogs and other animals susceptible to rabies.

* * * * *

HORSEMEN'S RALLY AT EPSOM

"The Surrey Horse Association is to be congratulated," says the Special Correspondent of *The Times* in the issue of Monday last, "on arranging a remarkable rally of horsemen on Epsom Downs at Tattenham Corner on Sunday." Long before the appointed hour of meeting groups of horsemen and horsewomen began to converge on the sunlit downs until more than 300 mounted people had assembled, with all sorts of horse-drawn vehicles, including Mr. D. Jacobs's four-in-hand, hackney tandems, pairs, and single-harness horses of all descriptions, commercial greys among them. Supporters and holiday-makers numbering some thousands also attended.

"The Rev. A. L. Bird, Vicar of Burgh Heath, conducted a brief outdoor service with the congregation, mounted and on foot, making a wide circle round him on the turf. The theme of his address was the trust and sympathy that should exist between man and beast, best typified by the proper practice of horsemastership, which the association constantly labours to improve.

"After the service Mrs. V. D. S. Williams gave a polished display of elementary dressage on her bay horse, Pilgrim, in which the willing co-operation of the mount was obvious.

"Subsequently the gathering moved off to the grandstand on the racecourse, mustered there, formed up, and came back to the starting-point, where each received the association's rosette as a memento of a notable occasion.

"The parade was led by Mr. Nigel Colman, President of the Association, in his gig, with a grand little hackney pony in the shafts. He was followed by the coach drawn by four grey horses, and behind came an assortment of vehicles of all kinds, tandems, pairs, family utility turnouts, drawn by ponies and horses, and a long line of horsemen variously mounted. One contingent led by Major Duffy came from Brentwood, in Essex.

"The organisation reflected credit on the Secretary of the Association, Mr. Salathiel, and the Chairman, Mr. R. S. Summerhays. Not the least remarkable aspect was the extraordinarily good condition of every horse in the parade, and their even more remarkable quietness throughout the service, demonstration, and final parade."

* * * * *

SCIENCE LIBRARIES' SHORTCOMINGS

"Library facilities in science and technology are a disgrace to Britain," Dr. Percy Dunsheath said in his presidential address to the Association of Special Libraries and Information Bureaux conference, held recently at Ashorne Hill, near Leamington Spa. He called on the Government for a new library in the centre of London "conceived on a grand scale." The Board of Trade and the Ministry of Education, he said, had not recognised the educational value of a highly efficient library in the fields of science and technology. Stocks of books in important libraries were not readily available for want of space, grants for new books fell more and more into arrears, and the flood of new knowledge was more and more getting beyond the capacity of the underpaid, under-staffed and under-equipped librarian to cope with. The best technical library in the United Kingdom, the Patent Office Library, in London, which formerly kept open until 10 p.m., now closed at 6 p.m.

In comparison with America, the science and technology provisions in our own public libraries were many decades behind. Britain would never compete as long as it had a "five-day week and no overtime outlook" in learning.

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WINTER RATIONS FOR CALVES

As announced by the Minister of Agriculture in the House of Commons on July 27th, a ration will be provided for calves between six and 12 months old during the coming winter.

The ration will be ¼ cwt. protein and ¾ cwt. cereal per month for each calf. It will be allowed during the period October, 1949, to April, 1950, on application, for all calves between six and 12 months old which are being reared for milk or beef, irrespective of whether milk is sold off the holding.

This step has been made possible only by an improvement in the short term prospects for imports of animal feeding-stuffs from non-dollar sources and there can be no promise that it will be repeated next year. The ration will enable at least one batch of calves on the farm to be better finished than is possible at present.

The existing arrangements for the provision of special calf food for calves under six months old will remain unaltered.

DEATHS OF NATIONAL STUD YEARLINGS FROM ANTIMONY POISONING

Three of eight National Stud yearlings intended for sale at Messrs. Tattersall's yearling sales at Doncaster have died. Two died before the sales, and of the six animals sold, one, a filly, sold for 2,000 guineas, died shortly afterwards.

Following *post-mortem* examination at the Equine Research Station, Newmarket, the Ministry of Agriculture and Fisheries issued the following announcement (September 12th): "It has now been established that the deaths of the two yearlings which died at the National Stud recently were due to antimony poisoning. The organs of the third horse from the Stud which was purchased last week at the Doncaster sales and has since died, are now being tested to see whether the death of this filly is attributable to the same cause. Every effort is being made to trace the source of the poisoning and to ascertain whether it can have been introduced in some way in the food of the animals."

* * * * *

New Dehorning Caustic.—The USDA Regional Animal Disease Laboratory, Auburn, Ala., has announced a "better" dehorning material composed of antimony trichloride, 28 per cent.; salicylic acid, 7 per cent.; and flexible collodion, U.S.P., 65 per cent.

* * * * *

Trials with various commercial oestrogen pellets for poultry have revealed a wide variation in efficacy, according to a research progress report of the University of California.

* * * * *

The editorial offices of *Veterinary Medicine* (formerly located in Chicago) have been moved to Kansas City, Missouri—the heart of America's livestock producing region. All communications should be addressed as follows: *Veterinary Medicine*, Suite 803, Livestock Exchange Building, Kansas City 15, Missouri, U.S.A.

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Walter Herriot & Co., Ltd., Incorporated Insurance Brokers, announce that they are moving, on September 26th, 1949, to larger premises at Regis House, King William Street, London, E.C.4. Telephone Nos. MANsion House 1600 and 6623 unaltered.

CORRESPONDENCE

The views expressed in letters addressed to the Editor represent the personal opinions of the writer only and their publication does not imply endorsement by the N.V.M.A.

SKIN INFECTION, PRESUMABLY FROM A CASE OF COW POX

Sir,—This is a description of a skin condition which was contracted last year. It is recorded in the hope that it may be of interest and perhaps help to any colleague who may become infected.

The first lesion was a small, non-painful, red, shiny area on the left thumb (*vide* lesion "A" in photograph). The nodule was the size of a split pea, raised and divided by a fissure, whilst the centre of each half bore a small crescentic, white area. After a few days this lesion began to itch.

No attempt at treatment was made and in five to six days "dimpling" of the crescentic centres was very noticeable.

In a further seven days the nodule was the size of a sixpence and exuded beads of serum. It was painful on pressure and commencing axillary lymphadenitis was causing a fair degree of discomfort, slight pyrexia, but little malaise.

At this time (about two to three weeks after the lesion was noticed) the site of lesion "B" on the right thumb became irritable and a small firm swelling arose. In three days this swelling had enlarged, softened and its substance resembled "tapioca" pudding due to small pin heads of serum which later became confluent until a bulla was formed. This was not painful, and no lymphadenitis occurred in the associated axilla. After expression of the serous contents the bulla refilled.

The lesion "A" developed until it resembled a small flat ulcerating wart and in about a month from its onset it dried to form a scab, which on removal left a red shiny scar. The lesion "B" after repeated rupture progressed much as an ordinary blister.

After a total time of about five to six weeks the nodules caused no inconvenience but even after four months the sites were easily dis-

cernible as red, shiny areas, hyper-sensitive to the touch and irritable to heat.

Attempts to transmit the condition to the teats of a dry cow and drying off heifer, by bandaging a piece of gauze soaked in the serum from the bulla, were unsuccessful, but I believe that infection from a case of cow-pox was the cause of the condition.

No treatment influenced the course of the course of the condition and the symptomatic treatment such as fomentation of the axilla, and the administration of febrifuges afforded prompt relief.

Yours faithfully,

Old Sarum House,
Stratford Road,
Salisbury.

PETER J. DALTON.

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THE PERSISTING VALUE OF HORSEMANSHIP IN A GOOD VETERINARY TRAINING

Sir,—Mr. H. W. Steele-Bodger's most interesting note in your issue of last week on the 30th International Horse Show cannot be allowed to escape tribute for at least two reasons.

Firstly, it calls attention, for what I believe to be the first time for several years, to what our profession, with the rare exceptions he has brought so well into prominence, has lost during the last couple of generations through decline in interest in horsemanship and horsemastership. Where, following the admission to the schools everywhere of young people whose interest in the living animal is and remains no more subjective than if it were a *post-mortem* specimen, laboratory culture medium, or, worst of all, a mere cipher in statistical returns, some interest is taken by a few, it is nearly always limited to the cruder forms of horsemanship represented by hacking and hunting.

This was brought home to me forcibly during my recent stay in Egypt when I was honoured with admission to their very select school of horsemanship, the Faroussiah Club. What there is to be gained in knowledge of the living animal and in immense interest by placing oneself under the strict tutelage of outstanding masters of the High School art can only be well appreciated when one has actively experienced it. All that Mr. Steele-Bodger has said so well concerning the methods adopted by the distinguished leader of the Spanish Riding Academy, Colonel Alois Podhajsky, of Vienna, was then borne out, the riding instructor at the Club being himself a retired Austrian officer and so probably a former colleague.

Some years ago, a distinguished Army officer, who soon afterwards rose to be C.I.G.S., visited me in India and I questioned him as to why a simple Cavalry officer often rose to far higher eminence in command of armies in the field than others who had been through long academic courses of military training or acquired great skill in the more technical arms of the service. His prompt and simple reply was: "Because the one has knowledge how to handle men: the others have none." May it not be *a fortiori* that for the essential craft of the veterinarian, the insight into the phenomena of comparative psychology so acquired through intimate association with the horse and its rider or as its rider, may likewise conduce towards ultimate higher achievement?

Several months ago I was consulted by an old friend, now Principal of one of our Veterinary Colleges, in regard to the feasibility of attaching a Riding Academy to his school. Without hesitation I had to endorse heartily that project. Not long after the introduction of anatomy, "the first of the accretions," into the veterinary curriculum, the great sporting writer Nimrod, a great friend of the rising veterinary profession and a frequent contributor to *The Veterinarian*, was sighing at the production of a race of men singularly well versed in the minute details of structure of the horse but oblivious of the most ordinary responses of the living horse. He well appreciated, he said, one could never know too much about structure but he could not allow that such knowledge must be acquired by corresponding neglect of what had formerly been regarded by the public as a prerequisite in a really competent veterinarian. Our anatomists insist—in spite of all argument that it is no longer the most important veterinary subject (being far superseded now in respect of economic importance, at least, by such species as the ox and the fowl)—that the horse remains the ideal dissecting subject in ordinary teaching. Should we concede to them that point, if only because they can retort with some justice that they must know their job of teaching much better than the rest of us who are not specialist anatomists, then can it not be asserted with almost equal justification, that the horse also remains the most ideal living subject upon which the veterinary student can acquire the necessary insight into the elementary phenomena of animal behaviour and animal management?

Yours faithfully,

University of London Club,
21, Gower Street,
London, W.C.1.

J. T. EDWARDS.

September 10th, 1949.

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APPOINTMENT OF LECTURER IN ANIMAL HUSBANDRY AT BRISTOL

Sir,—I would refer to the advertisement dealing with the above in *The Veterinary Record* of August 27th.

Surely the new school is getting away to a bad start and showing scant appreciation of what brought it into being when it proposes to entrust instruction in the practical aspects of stock farming to someone who need not be a veterinary surgeon.

Doubtless the Council, R.C.V.S. will deal with the matter in its own good time but how much better if the offending notice had not appeared, especially in our own journal.

Unfortunately our pre-occupation with disease has encouraged the belief that we are not interested in or competent to deal with the other aspects of farm animal work, but a teaching school is not the place to illustrate that belief. The present, when we are on the threshold of what should be a new era, offers an excellent opportunity of revising our policy to one embracing the whole farm animal field. If we fail to do so then I am afraid we must continue to meet the old frustrations, and even humiliations, for which professionally an artificial financial prosperity in practice is poor compensation.

Let us try to remember that the veterinary course, with all its faults, is the only standard one with any claim to be a logical basis for farm animal work.

Yours faithfully,

JOHN C. GRANT.

August 30th, 1949

Aberdeen.

ADVERTISERS' ANNOUNCEMENTS

BURROUGHS WELLCOME & CO., 183-193, Euston Road, London, N.W.1, announce that "Lutormone" is now available in the form of compressed products for the convenient preparation of hypodermic injections. Two strengths are issued, 50 units for small animal practice, tubes of 10, 15s., and 500 units for large animal practice, tubes of 10, £2 10s. (Prices subject to professional discount).

Reduction in Purchase Tax

BURROUGHS WELLCOME & CO., 183-193, Euston Road, London, N.W.1, announce that under Purchase Tax (No. 3) Order 1949, the following veterinary products are now exempt from purchase tax. "Wellcome" brand Anti-Bronchisepticus Serum; "Wellcome" brand Anti-Hard Pad Serum.